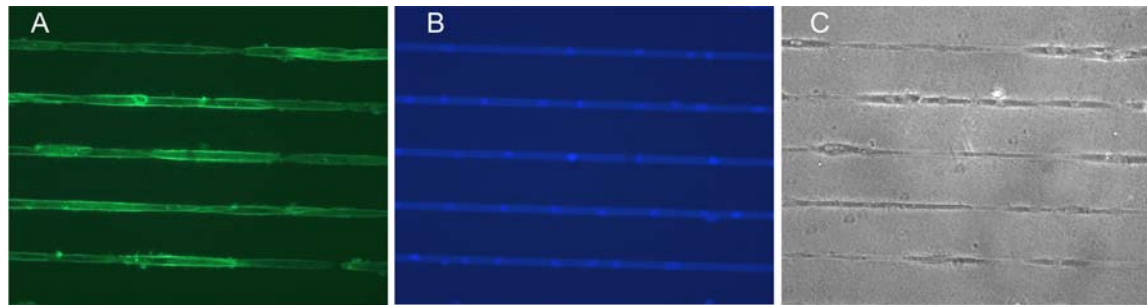


Superhydrophobic and Hydrophilic Multilayers for Patterned Cell Growth

Joe Schlenoff, Florida State University, DMR-0309441

We have developed a set of new polyelectrolyte materials for making multilayers of hydrophobic contrast: a very *hydrophobic* fluorinated polyelectrolyte, an ideal substrate for the attachment and growth of smooth muscle cells, and a *hydrophilic* zwitterionic copolymer, that resists completely the attachment of cells, proteins and even platelets. Microcontact stamping techniques are used to imprint patterns of the hydrophobic polymer on a multilayer surface of hydrophilic polymer. Smooth muscle cells attach and spread on the hydrophobic features. As seen in the Figure, no cells are observed growing on the intervening hydrophilic area. The stains below highlight the cell walls (green stain) and the cell nuclei (blue). The muscle cells are clearly growing in a remarkably ordered end-to-end pattern. Submitted to *Biomacromolecules*



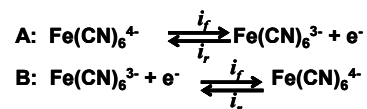
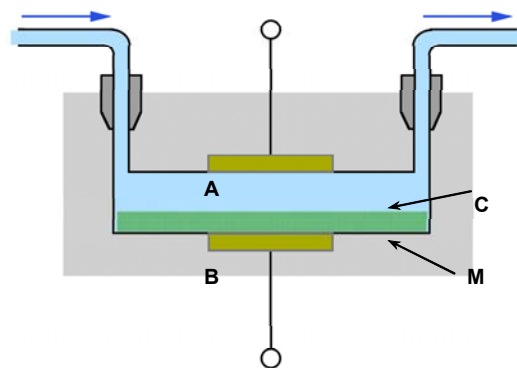
Micropatterning of cells grown on 20 μ m wide ridges of hydrophobic polymer, spaced 80 μ m, stamped on hydrophilic polymer. (A) Fluorescently labeled phalloidin staining actin (B) Cell nuclei fluorescently labeled with DAPI and (C) a phase image of the same micropatterned area (scale bar = 80 μ m).

An Ion Transistor

Joe Schlenoff, Florida State University, DMR-0309441

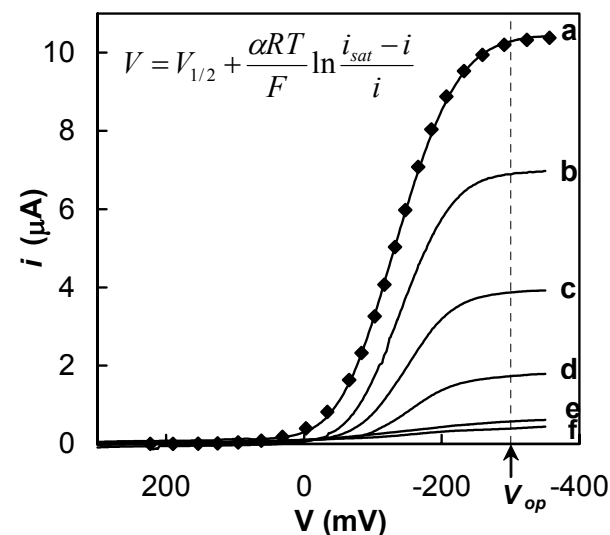
We have introduced a new device where ion currents through ion permeable polyelectrolyte multilayer membranes are regulated by solution ionic strength. The device shows many transistor-like properties, including rectification of ion currents and “gating” of currents by chemical potential (i.e. concentration) instead of electrical potential.

In press *Electrochem. Solid State Lett.*



The salt gated “transistor.” Two electrodes, one coated with a polyelectrolyte multilayer (m), and the other bare, are separated by a channel (c) containing a constant concentration of redox-active probe ions and a variable concentration of salt.

A salt-gated family of i/V curves. Current flows through the multilayer according to the equation shown, where i_{sat} is the saturation current, $V_{1/2}$ the half-wave potential



Ultrahydrophobic Surfaces

Joe Schlenoff, Florida State University, DMR-0309441

Ultrathin films of fluorinated polyelectrolytes have been developed with support from DMR. The films, prepared by solution processing under ambient conditions, are very hydrophobic, some more so than Teflon™. When particles of the clay mineral Attapulgite, a naturally-occurring nanorod found near FSU, are incorporated within the fluorinated film, the surfaces are ultrahydrophobic, which means water droplets on them are nearly spherical and they roll easily on the surface, as in the “Lotus effect.” Submitted to *Angewandte Chemie*



Water droplets sitting on an ultrahydrophobic nanocomposite film of fluorinated polyelectrolyte and clay nanorods.

DMR-0309441, Joe Schlenoff, Florida State University,

Education & Collaborations:

With partial support from this grant, three students have completed their Ph.D degrees: Hassan Rmaile is now at Hercules Inc (Delaware), Zhijie Sui and David Salloum finished in August 2004. Undergraduate students Mark Wang and Claudiu Bucur participated in the project. Claudiu joined Rana Jisr as a Ph.D student currently bringing the DMR projects forward. We have enjoyed collaborations with Biology colleagues Tom Keller and Bryant Chase, and access to the neutron source at NIST for structural studies of our thin films.